CHAPTER 5

The language of the Transeurasian farmers

Martine Robbeets
Max Planck Institute for the Science of Human History, Jena

The Farming Language Dispersal Hypothesis makes the radical and controversial claim that many of the world's major language families owe their present-day distribution to the adoption of agriculture by their early speakers. Especially for regions such as Northern Asia, where farming is only marginally viable, this claim has been seriously called into question. This paper investigates to what extent agriculture impacted the dispersal of the Transeurasian language family, i.e. the genealogical grouping consisting of the Turkic, Mongolic, Tungusic, Koreanic and Japonic languages. For this purpose, I establish the internal family structure of Transeurasian, reconstruct cultural vocabulary and situate the Transeurasian languages in time and space. Assessing the cultural reconstructions and mapping the tree topology, time-depth and homeland on the demographic transitions visible in the archaeological and genetic record, I find indications that proto-Transeurasian was spoken by people gradually adopting farming and that its dispersal was indeed driven by agriculture.

Keywords: Transeurasian, Farming Language Dispersal Hypothesis, genealogical relatedness, homeland, Neolithic

1. Introduction

In this chapter, I use linguistics as a window on early human and agricultural expansion in North and East Asia. My aim is to investigate to what extent agriculture impacted the ancestral proto-Transeurasian language and its early dispersals. The term "Transeurasian" refers to a large group of geographically adjacent languages, given in Figure 1. They stretch from the Pacific in the East to the Baltic and the Mediterranean in the West and include up to five different linguistic families: Japonic, Koreanic, Tungusic, Mongolic, and Turkic (Johanson & Robbeets 2010: 1–2). I distinguish "Transeurasian" from the more traditional term "Altaic", which I reserve for the linguistic grouping consisting of Tungusic, Mongolic and Turkic languages only.

DOI 10.1075/z.215.05rob

Figure 1. The Transeurasian languages (generated with WALS tools)

There is an ongoing controversy about the genealogical relatedness of these languages. In my research so far, I have shown that the majority of Transeurasian etymologies proposed in support of inheritance are indeed questionable. However, rather than proposing a wholesale rejection of Transeurasian, I have argued that there is nonetheless a core of reliable etymologies that enables us to classify Transeurasian as a valid genealogical grouping. The evidence (Robbeets 2005, 2015) consists of an inventory of regular consonant and vowel correspondences, common lexical etymologies including basic vocabulary and shared verb morphology.

New questions emerge from the assumption that proto-Transeurasian was an actual spoken language ancestral to the Japonic, Koreanic, Tungusic, Mongolic, and Turkic languages. What populations corresponded to the speakers of proto-Transeurasian? Where and when did these people originally live? When did the language family separate into its main branches? What triggered the expansion of the daughter languages? In which directions did the dispersals go? And, when, how and why did the daughter languages move to their present locations? In this chapter, I will argue that the speakers of proto-Transeurasian were familiar with millet cultivation and gradually developed farming during the Neolithic in the West Liao River region of Northeast China. I will suggest that the eastward linguistic expansions of the Transeurasian languages were initially driven by the spread of agriculture.

For some linguists, researching agricultural expansions in Northern Asia sounds as promising as looking for plants on Mars. With regard to "Altaic", Heggarty and Beresford-Jones (2014: 4) for instance, argue that "Northern Asia is home to environments where farming is either not viable at all or only marginally so … In

this sense, these regions fall by definition outside the scope of the farming/language dispersal hypothesis". In this chapter, I will show that it is a misconception to assume that certain subsistence patterns, such as nomadic pastoralism or hunting-gathering, have always prevailed in the Transeurasian region. I will argue that the family structure, homeland, time-depth and vocabulary of proto-Transeurasian leave room for a hypothesis that correlates the origin and spread of the language family with the Neolithic transition to farming in Southern Manchuria.

To this end, I will apply the different methods and principles for determining the time, location and cause of linguistic dispersals discussed in the introduction of this volume to the case of the Transeurasian languages. The following section searches for a plausible homeland for the Transeurasian family, using the diversity hotspot principle. Section 3 proposes a tree topology and a time estimate for the nodes in the Transeurasian family on the basis of Bayesian phylogenetic inference. Section 4 maps the tree topology, homeland and time-depth on demographic transitions in the Southern Manchurian Neolithic. Section 5 reconstructs cultural vocabulary for proto-Transeurasian. By way of conclusion, Section 6 summarizes the main arguments for identifying the speakers of proto-Transeurasian with the first farmers in the region and for associating the spread of their language with farming dispersals.

2. The diversity hotspot principle

A loose principle that can help us in locating the original homeland of a language family is the "diversity hotspot principle". It is based on the assumption that the homeland is closest to where one finds the greatest diversity with regard to the deepest subgroups of the language family.

From Chinese historical records such as the *Shiji* 'Records of the Grand Historian' (109–91 BC), the *Sanguoji* 'Records of the Three States' (284 AD) and the *Houhanshu* 'History of the Later Han' (5th century AD), we can infer that the Turkic, Mongolic, Tungusic, Koreanic and Japonic languages have all spread to their present-day locations from an area comprising Korea, southern Manchuria and Inner Mongolia. Therefore, even critics of the affiliation of the Transeurasian languages, such as Janhunen (1996) situate the original speech communities of the individual families in the compact area represented in Figure 2. Although the contemporary focus of diversity may diverge, the greatest linguistic diversity in recorded history, and therefore perhaps the location of the Transeurasian homeland, is in the West Liao River region in southern Manchuria.

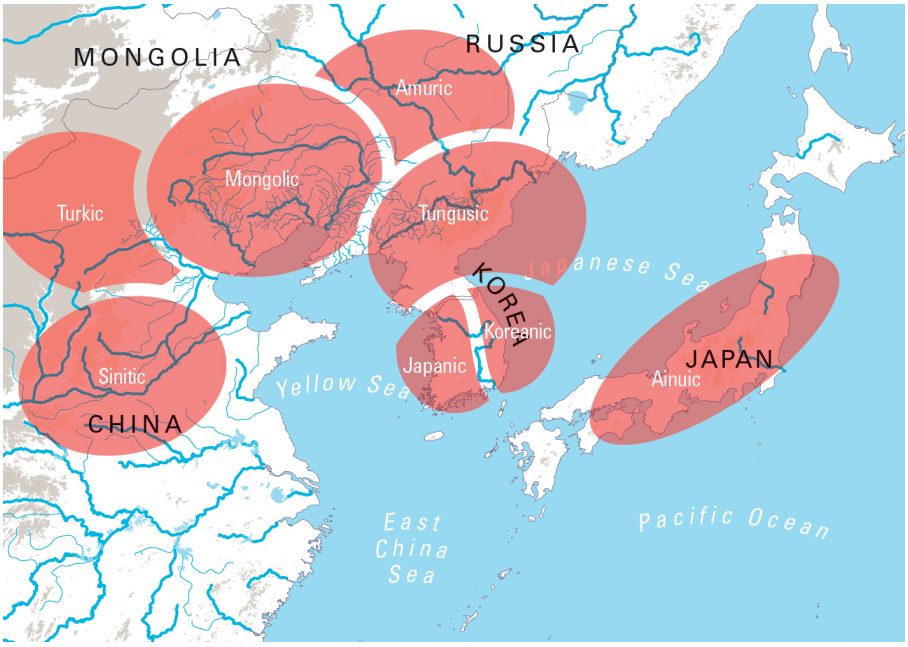

Figure 2. The ethnic groups of prehistorical Manchuria in the last millennium BC according to Janhunen (1996: 216): 1. Sinitic; 2. Turkic; 3. Mongolic; 4. Amuric; 5. Tungusic; 6. Koreanic; 7. Japanic; 8. Ainuic

3. Bayesian phylolinguistics

Although Bayesian phylogenetic inference cannot establish genealogical relatedness between a set of languages, it can be useful to double-check the internal structure of a language family reached by applying classical historical linguistics. Additionally, Bayesian inference can provide us with absolute dates for the nodes in the family and give us an idea of the robustness of our inferences. In a forthcoming study with Remco Bouckaert (Robbeets & Bouckaert forthcoming), we performed a preliminary Bayesian phylolinguistic analysis on the Transeurasian etymologies represented in the Leipzig-Jakarta basic vocabulary list (Tadmor et al. 2010). We used an alternative coding principle, whereby we started from a reconstructed proto-Transeurasian basic item and coded 1 for the presence of a cognate in a daughter language and 0 for the absence of a cognate, irrespective of whether the meanings were identical or not. Taking into account time calibrations for 4 lower nodes in

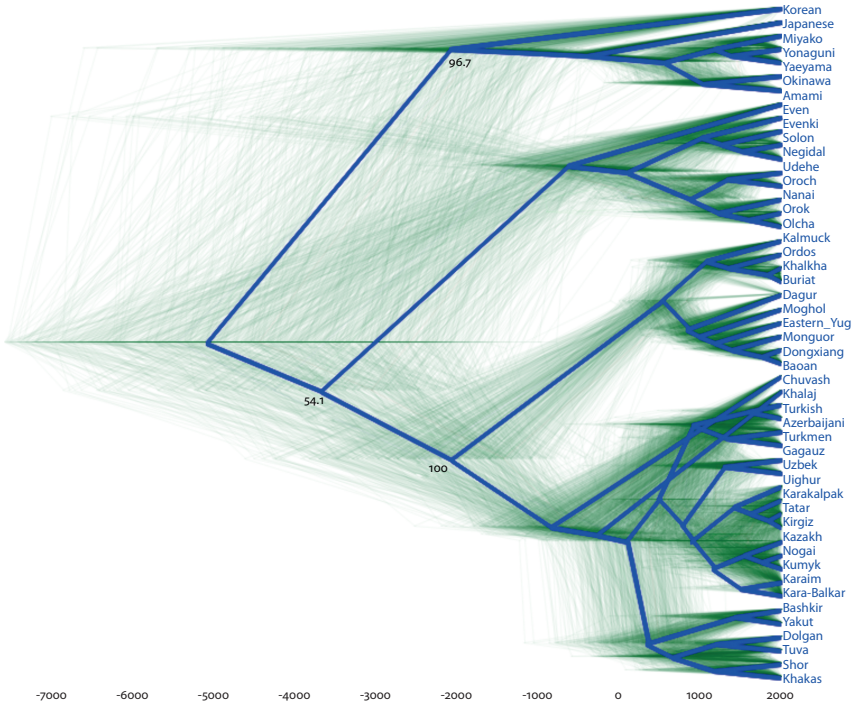

Figure 3. Densi Tree of the Transeurasian family (Robbeets & Bouckaert forthcoming)

the Transeurasian family we ran a Bayesian algorithm on the data. The preliminary result is captured in the Densi Tree, given in Figure 3.[1]

In addition to proposing an internal structure for the Transeurasian family, the Bayesian analysis also provides us with estimates for the absolute time depth

1. The Bayesian tree confirms the classification proposed in Robbeets (2015) on the basis of the classical comparative method, except for the position of Tungusic vis-à-vis the other branches. I previously classified it in a unity with Turkic and Mongolic whereby Turkic – rather than Tungusic – branched off first. In contrast to the Bayesian method, which seeks a tree that explains the observed data by quantifying how likely it is that they have been produced by a certain evolutionary process, the classical method is a parsimony method, which seeks a tree that explains the dataset by minimizing the number of changes required to produce the observed state. Thus, the classical comparative method is based on shared innovations: it prefers trees that place innovations where they create the greatest amount of diversity. In the case of Transeurasian the innovations can be phonological (e.g., the loss of voicing distinction in Japanese and Korean, maintenance in Altaic, but loss of certain word-initial voice distinctions in Turkic), syntactic (e.g., the change from 2-way to 3-way distinction in Japanese and Korean demonstratives) or morphological (e.g., the original Transeurasian negative pTEA **ana-* is replaced by **ə-* in Altaic and again by **-mA-* in Turkic).

of the root and the primary nodes in our tree. The estimates are given in Table 1, along with their credible intervals. The observation that the time depth of the root coincides with the start of millet cultivation in Northeast China's West Liao River Region is striking, to say the least.

Table 1. Bayesian time estimates for the primary splits in the Transeurasian family

Node	Time depth	95% HPD credible interval
proto-Transeurasian	5700 BC	6800–4200 BC
proto-Altaic	4600 BC	6100–2800 BC
proto-Japono-Koreanic	3300 BC	5500–1300 BC
proto-Mongolo-Turkic	2800 BC	4800–800 BC

4. Linking demographic pulses to language dispersals

Recently, the archaeobotanists Stevens and Fuller (forthcoming) identified the following three phases in the development of agriculture in Southern Manchuria: (1) the establishment of millet agriculture (6500–4500 BC); (2) the eastward spread of millet agriculture (4500–3000 BC) and (3) the integration and spread of rice and millet agriculture after 3000 BC. It is inviting to map these three phases in the development of agriculture with linguistic stages in the Transeurasian family tree.

4.1 The establishment of millet agriculture

Millet cultivation began around 6200 BC in the Xinglongwa culture (6200–5400 BC), one of the earliest farming cultures in northeast China. There is early evidence for the cultivation of millets, notably large quantities of broomcorn millet (*Panicum miliaceum*) and small amounts of foxtail millet (*Setaria Italica*) (Zhao 2011: 301). There is a continuity of cultivation tradition with the ensuing Zhaobaogu (5400–4500 BC) and Hongshan cultures (4500–2900 BC). In contrast to the millet-focused subsistence in the Yellow River Region, the Xinglongwa people in the West Liao River Region subsisted on a broad-spectrum strategy, using various wild and cultivated plants, including roots, beans, and nuts (Shelach 2000; Hunt et al. 2008; Weber & Fuller 2008; Zhao 2011; Liu et al. 2012; Liu et al. 2016). The small size of the recovered millet grains indicates that cultivation was still in a pre-domestication stage. It took almost two millennia for millet to become fully domesticated. The environmental conditions in the West Liao River region are extremely vulnerable to climatic changes. The strengthening of monsoon around 6200 BC increased precipitation and contracted dunefields, facilitating cultivation and leading to the

expansion of early Neolithic cultures such as Xinglongwa and Zhaobaogou (Jia et al. 2017). In my hypothesis, the people depending on broad-spectrum subsistence spoke proto-Transeurasian and the first-order linguistic split between Altaic and Japano-Koreanic took place towards the end of the domestication process. Figure 4 shows the location of the Xinglongwa culture and thus the presumed homeland of proto-Transeurasian.

Figure 4. The Xinglongwa culture and the establishment of millet agriculture

4.2 The eastward spread of millet agriculture

By the time of the so-called Hongshan culture (4500–2900 BC), millet agriculture diffused eastwards, first, to the Liaodong peninsula and later to the Russian Far East. Kuzmin (2013: 8) places the appearance of millet cultivation in the Primorye around 2700 BC in the context of the early Zaisanovka cultural complex (4800–1500 BC), but evidence for agriculture is lacking for the adjacent Boisman culture (4825–2470 BC). In the forest steppe area of the southern Primorye, natural conditions such as open spaces and a drier climate were more favourable for millet cultivation than in the inhospitable forested areas of the north. As the Hongshan population levels were too low to have created resource scarcity (Peterson & Drennan 2011: 106; Drennan & Dai 2017: 464), the spread of millet was not driven

by a population boost, but rather by climate change. Around 2800 BC a weakening of the monsoon and reduction in precipitation led to a major demographic decline and the collapse of the Hongshan culture (Jia et al. 2017). This climate change also affected the maritime-adapted cultural complexes of the Primorye's coast, through cooling, landscape changes and falls in sea level, which disrupted the traditional subsistence base of local hunters and fishermen (Vostretsov 2006). The region between the Liao River and the southern Primorye of the Russian Far East had been in a state of active contact, exchanging obsidian, since before the Neolithic. Therefore, the Hongshan populations could easily spread their millet agriculture and impressed pottery once the climate change called for a shift in subsistence regime.

Wang et al. (2016) have recently established genetic continuity between ancient DNA from 7 individuals from the Neolithic Boisman culture and speakers of most contemporary Tungusic languages. They find that contemporary Ainu and Nivkh speakers reflect the original Boisman genome but contemporary Tungusic speakers reflect Boisman genes that have been admixed with an additional component. This may indicate that the genetics of modern Tungusic speakers reflect the past admixture of local Nivkh genes with the genes of incoming Transeurasian farmers.

Therefore, as illustrated in Figure 5, I suggest identifying the Hongshan people with the speakers of Altaic, the outlying Hongshan culture on the Liangdong Peninsula with the Japano-Koreanic language and the people who adopted millet-agriculture in the Russian Far East with Tungusic speakers. From the Liaodong peninsula, millets were spread overland to the Korean peninsula in the fourth millennium BC (Ahn 2010; Ahn, Kim & Hwang 2015: 2; Crawford & Lee 2003: 2; Lee 2011). It is conceivable that the people who introduced millet agriculture to Korea were the speakers of proto-Koreanic. The split between proto-Japonic and proto-Koreanic thus occurred on the Liaodong Peninsula and not on the Korean Peninsula. The early date of the Japano-Koreanic split (3300 BC) in the Bayesian estimation above is consistent with the date of the importation of millet agriculture in Korea (ca. 3500 BC).

Figure 5. The Hongshan culture and the eastward spread of millet agriculture

4.3 The integration and spread of rice and millet agriculture

After 3000 BC, rice was added to the agricultural package in the Liaodong – Shandong interaction zone. According to Kim (2003), the millet cultivators on the Korean peninsula had returned to nomadic hunting-gathering by the second millennium BC, perhaps due to another wave of climatic cooling. Archaeobotanical studies such as Bale (2001), Miyamoto (2009) and Ahn (2010) show that wet-rice agriculture came to the Korean peninsula in the late second millennium BC (1300–1000 BC) via the Shandong and Liaodong peninsulas. The second transition from foraging to farming on the Korean peninsula involved not only a cultural shift, but most probably also a linguistic one: the people who brought wet-rice agriculture to Korea may have spoken proto-Japonic. In the first millennium BC the rice and millet farmers arrived via the Korean Peninsula in Japan, where they established the Yayoi culture (900BC–300AD) (Crawford & Shen 1998; Crawford & Lee 2003).

The archaeological evidence is supported by Kanzawa-Kiriyama's (2016) study using nuclear genome sequencing of two Jomon (14,000–900 BC) individuals. They confirm the mainstream "dual structure model", originally proposed by Hanihara (1991) and recently supported by Jinam et al. (2012) and Jeong et al. (2016), describing the Mainland Japanese population as an admixture of native Jomon genes and

incoming Yayoi genes from farmers coming from the Korean peninsula. I associate the spread of integrated rice and millet agriculture through Korea to Japan with the spread of the Japonic language. This is illustrated in Figure 6.

Figure 6. The Yayoi culture and the integration of rice and millet agriculture

4.4 Demography mapped on linguistic phylogeny

Mapping the above demographic processes on the Transeurasian tree, we find the correlations visualized in Figure 7. Proto-Transeurasian is associated with a gradual development of millet cultivation, the first-order split in the family with the full domestication of millet, the separation of Koreanic and Tungusic with the eastward spread of millet, and proto-Japonic is associated with later migrations driven by integrated rice and millet agriculture.

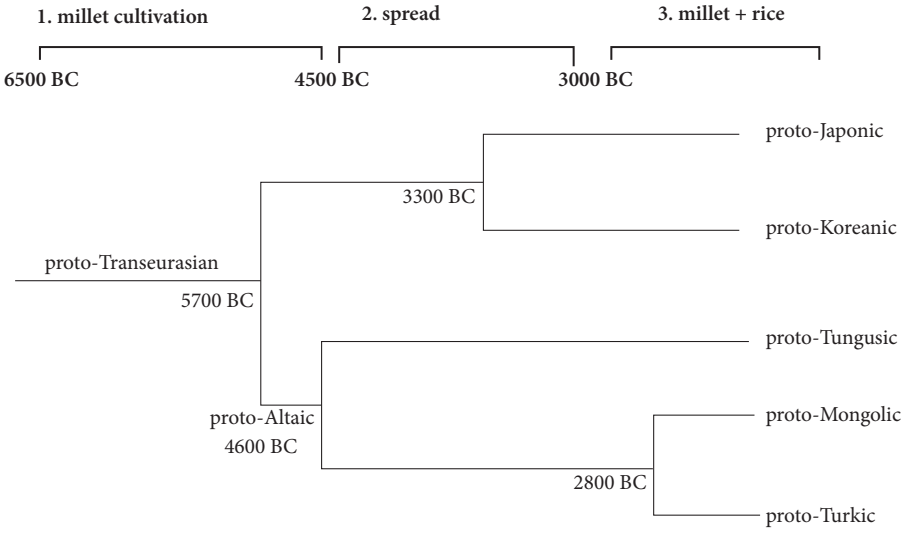

Figure 7. Mapping the agricultural development in Northeast Asia on the language tree of Transeurasian

5. Cultural reconstruction

Cultural reconstruction enables us to study human prehistory by correlating our linguistic reconstructions with information from archaeology about the cultural and natural environment in which the speakers of the proto-language likely operated. This method is also known as "Linguistic paleontology", "Wörter und Sachen" or "Linguistic archaeology". Reconstructed vocabulary associates proto-Transeurasian with broad-spectrum subsistence including millet cultivation. In addition to evidence for cultivated fields, seed and consumable plants such as a millet-like crop, nuts and roots, I reconstruct subsistence activities such as "sowing", "grinding", "kneading", "weaving", "sewing", "making rope" and indirect evidence for pottery production. Interestingly, proto-Transeurasian lacks maritime vocabulary and terms for rice agriculture, while Japano-Koreanic reflects coastal subsistence terms but still lacks rice vocabulary (Robbeets 2017).[2] Therefore, cultural reconstruction

2. Francis-Ratte (this volume) reconstructs pJK **yɔ* '(dry) rice', suggesting that Japanese and Korean may have diverged at a time when field rice was already being cultivated in Northeast Asia while paddy rice was not introduced yet. However, there is only a single cognate set relating to rice and it is rather dubious as the participating cognates are based on a morphological segmentation of MK (*p-*)*yé* 'rice plant, kernel of rice (unhusked)' and OJ *yo*(*-ne*) 'uncooked rice'.

indicates that the time-depth of both proto-Transeurasian and proto-Japano-Koreanic preceded the integration of rice agriculture starting around 3000 BC. Additionally, it indicates an inland location for proto-Transeurasian in contrast to the homeland of proto-Japano-Koreanic, which seems situated on the coast.

5.1 Economic plants and cultivation

(1) pTEA **pata* 'field for cultivation'

a. Turkic: pTk **(p)atï ~ *(p)ata* 'field irrigated for cultivation' (pTk **-z* collective suffix, pTk **-(A)g* place suffix?)
OT (Karakhanid) *atïz* 'any strip of land between two dikes', MTk. *atïzla-* 'to create an irrigation canal in a field', Uig. *etiz* 'watered field, boundary', Tkm. *atɨz* 'watered field, boundary', Shor *adɨs* 'a measure for fields, 1/18 dessiatin (= ca. 607 square meters)', Kirg. *adɨr* 'hilly terrain', Kaz. *atɨz* 'a plot of land, watered by irrigation canals and properly limited'; MTk. *atov* '1 island', Tk. *ada* '1', Tat. *ataw* '1', Tkm. *a:da* '1', Chu. *odă* '1'

b. Koreanic: pK **patʌ* '(dry) field' (pK **-(ɨ/ʌ)k* place suffix)
K *path*, MK *path* '(dry) field, farm, patch, garden, position on a game board'

c. Japonic: pJ **pata* '(dry) field' (pJ **-ka* place suffix, pJ **-i* substantivizer)
J *hata* 2.4, OJ *pata* '(dry) field' J *hatake* (3.7a~b), OJ *patake*$_2$ 'field, farm, plantation, garden', Shuri (Okinawa) *hataki*, Naze (Amami) *hatəə*, Ishigaki (Yaeyama) *patagi*, Oura (Miyako) *patagi*, Yonaguni *hatagi,* pR **patake* 'field, croft'

The Turkic word pTk **(p)atï ~ *(p)ata* 'irrigated field for cultivation' can be reconstructed, considering pTk **(p)atï-z* 'watered fields' and pTk **(p)ata-g* 'island' as reflexes of the same etymon, whereby pTk **-z* represents a dual and collective suffix (e.g., in paired body parts such as OT *kö-z* 'eyes', *ti-z* 'knees', *agï-z* 'lips' and *kökü-z* 'breasts', ethnonyms such as OT *ogu-z* and *kïrgï-z,* sets of more than one such as *iki-z* 'twins', *üc-üz* 'triplet', *dörd-üz* 'quadruplet' and undefined quantities such as OT *yultu-z* 'stars', *yïldï-z* 'roots') and pTk **-(A)g* a petrified place suffix (e.g., pTk **o:t* 'fire' → *o:t-ag* 'tent, dwelling place'). The alleged loss of the initial labial stop **p-* cannot be confirmed since we lack a Khalaj cognate. The reconstruction of the final low vowel in pTk **(p)ata* is supported by the vowel in the Mongolic borrowing pMo **atar* 'uncultivated land'. Contrary to Ramstedt (1949: 192–293), Poppe (1960: 51, 82), Menges (1984: 284), Starostin et al. (2003: 1127) and Savelyev (this volume), I do not think that the Mongolic form reflected in WMo *atar* 'unploughed or fallow field', Khal. *atar*, Bur. *atar* and Mgr. *atər* is a cognate. Indications of borrowing are the lack of intial *f-* in the Monguor form *atər*, which would be the expected reflex

of pMo **p-* (e.g. pMo **poro-* 'to entwine' in (8)) and the fact that the Mongolic form is unsegmentable in spite of the morphological complexity of the Turkic form. In Korean, non-rising low monosyllabic place nouns ending in *-k* or *-h* commonly are reductions from disyllabic forms with a place suffix **-(ɨ/ʌ)k* in the second syllable (Martin 1996: 44–45), e.g., MK *pask* 'outside' (< **pasʌ-k*), *math* 'yard' (< **matʌ-k*), *alph* 'front' (< **alpʌ-k*), etc. The lack of aspiration in the derivation K *patwuk* 'stone checkers (game)' (< **pat tolk* 'field stones') may be indicative of the word for 'field' without place suffix. In Japonic, pJ **pata-ka-i* 'field, plantation' is probably derived from pJ **pata* '(dry) field' by means of the place suffix pJ **-ka*, which occurs also in *oka* 'hill', *arika* 'whereabouts', *sumika* 'residence' etc. The sharing of a corresponding place suffix on the word for 'field' in Turkic, Koreanic and Japonic may indicate that the derivation goes back to proto-Transeurasian.

(2) pTEA **pusu-* 'to sprinkle with the hands' ~ **pisi-* 'sprinkle with the hands, sow' → **pisi* 'what is sown' > **pisi* 'seed, seedling' (pTEA **-i* deverbal noun suffix) → ** pisi-ke* 'major crop' (pTEA **kA* plant suffix)

a. Mongolic: pMo **hüsü-* ~ **hisü-/hesü-* 'to sprinkle, throw out, jump around' → **hisi/*hesi* 'origin or base of a plant, shoot' (pMo **i* deverbal noun suffix)

pMo **hüsü-r-* ~ **hesü-r-/ *hisü-r-* 'to sprinkle, scatter; jump around' (pMo **r-* intensive)
Middle Mongolian *üsür-* '1 to spout, squirt out (of water); 2 to jump, leap (intr.),' Written Mongolian *üsür-* '1, 2,' Khalkha *üsre-* 'to squirt; to jump, leap, skip,' Buriat *hür-* 'to jump, leap,' Ordos *üsür-* 'to jump, leap,' Kalmuck *ösr-* 'to sprinkle (water), throw out sparks (of fire); jump or hop (of insects), to fly in the air' (Ramstedt 1935: 301), Dagur *xesere-* 'to jump' (Martin 1961: 161), *xəsur-*, *xesurə-* 'to sprinkle,' Eastern Yugur *husur-* 'to jump,' Dongxian *usuru-* 'to flow,' Monguor *fiʒuru-*, *fuʒuru-* 'to sprinkle, pour, cast (metal),' Moghol *üsürü-* 'to jump, leap' (Ramstedt 1906)

pMo **hisi* / **hesi* 'origin or base of a plant'
Middle Mongolian *nisi*, *hesi,* Written Mongolian *isi* ~ *esi* '1 foundation, basis, origin, source; 2 a stalk of grain, trunk of a tree, stem of a plant, shoot; 3 handle, grip,' Khalkha *iš* ~ *eš* '1 source, basis; 2 stem, stalk, trunk, underground stem; 3 handle, shaft' (Bawden 1997), Buriat *eše* '1, 2, 3,' Kalmuck *iš* '1 beginning, source; 2 stalk (of plant), stem (of tree), 3 handle, grip' (Ramstedt 1935: 210), Ordos *eši* ~ *iši* '1, 2, 3,' Baoan *jɛśi*, *heʂï* 'handle, grip', Dagur *xeš*, *xeši*, *heši* 'handle, grip, knob' (Martin 1961: 161), Eastern Yugur *šə* 'handle, stem,' Kangjia *heši* 'handle, grip' (Nugteren 2011: 354)

b. Tungusic: pTg **pusu-* 'to spread' ~ **pisi-* 'to sprinkle with the hands' / **pise-* 'to spread out' → **pise* 'offspring' (through pTg **i* deverbal noun suffix?) → **pisi-ke* 'broomcorn millet' (pTg **kA* plant suffix)

pTg **pusu-* 'to sprinkle, to scatter' ~ **pisi-* 'to sprinkle with the hands' / **pise-* 'to extend out'
Manchu *fusu-* 'to sprinkle (water), spew, spirt, squirt,' *fuse-* 'to propagate, to reproduce, to breed,' *fisi-* 'to sprinkle with the hands, to shake, to toss (one's sleeves),' *fise-* 'to project, to jut out, to fork, to branch' (Norman 2013), Sibe *fusu-* 'to sprinkle,' Even *hus-* 'to sprinkle (with water), splash, sputter, disperse', Negidal *xusi-* 'to sprinkle,' Olcha *pisuri-* 'to sprinkle,' Orok *pisitči-*, *possoḷi-* 'to sprinkle,' Nanai *pisi-*, *fisi-*, *fuksu-* 'to sprinkle' (Cincius 1975–1977: 39, 42, 355)

pTg **pise* 'offspring'
Manchu *fisen* 'relation, offspring, progeny' (Norman 2013), Okhotka dialect of Even *hesen* 'seed, offspring, kin' (Starostin et al. 2003)

pTg **pisi-ke* 'broomcorn millet'
Manchu *fisihe ~ fisike* 'glutinous millet, broomcorn millet (*Panicum miliaceum*),' *fisitun* 'a ritual vessel for offering millet; bowl for grinding millet, carved out from a piece of wood' (< *fisi* + *tetun* 'utensil') (Norman 2013), Olcha *pikse* 'millet,' Nanai *pikse* 'millet,' Kur-Urmi dialect *fisxe* 'millet'

c. Koreanic: pK **pusu-* 'sprinkle, scatter, wash, smash' ~ pK **pisi-* 'sprinkle, scatter, sow' → **pisi* 'what is sown' (pK **-i* deverbal noun suffix) > pK **psi* 'seed, lineage'
→ *pisi-k* 'major crop' (pK **-k* plant suffix) > **pski-* > **phi* 'barnyard millet'

pK **pusu-* 'to sprinkle, scatter, sow' ~ **pisi-* 'to sprinkle, scatter, sow'
K *pu:s-* '1 to pour, 2 to sow (tr.),' K *pu:s-* ~ K *puswu-* 'to smash, scatter, break,' MK *poso-* 'break, shatter,' K *pusi-* 'to wash, clean, rinse,' MK *puswoy-* 'to wash, clean, rinse (tr.),' K *pusule tuli-* 'to smash, to shatter into splinters (tr.),' K *pusule ci-* 'to crumble (intr.)' (K *le tuli-/le ci-* causativity polarizer < pK **(ʌ/ɨ)l-* anticausative), K *pusul pusul ~ posul posul* 'gently raining,' K *pusik ha-* 'to plant, extend' (MK *-i-* transitivizer < pK **-i-* causative); K *ppu:li-* '1 to sprinkle, rain slightly (intr.); 2 to sprinkle, shower, water (tr.); 3 to scatter, sow,' K *ppuli* 'a root (of a plant),' MK *spu·li-* 'to sprinkle' (MK *(u)li-* transitivizer < pK **(u)l-* anticausative + **i-* causative), MK *spih-* 'to sprinkle; slander,' K *p:al-* 'to wash, launder, wash out (tr.),' MK *·spol-* 'to wash (tr.)' (pK **(ʌ/ɨ)l-* pluractional), MK *·spum-* 'sprinkle, spout, spurt' (pK **mɨ-* ~ *mʌ-* inclinational)

pK **psi* 'seed, lineage'
MK *·psi*, K *ssi* '1 seed, kernel, 2 lineage, descent, breed,' K *pye-pssi* 'rice seed'

pK **phi* 'barnyard millet'
MK *·phi*, K *phi* '(Japanese) barnyard millet (*Echinochloa esculenta*)'

d. Japonic: pJ **piyai ~ *piyia ~ *piye* 'barnyard millet'
J *hie*, OJ *pi$_1$ye* '(Japanese) barnyard millet (*Echinochloa esculenta*)'

In the Mongolic verbs, the semantic shift from 'to sprinkle' to 'to jump' can be explained by observing the semantics of the Kalmuck verb *ösr-* 'to sprinkle (water), throw out sparks (of fire); jump or hop (of insects), to fly in the air,' in which the common denominator is 'to scatter of a set of small items.' The deverbal noun of this verb has the primary meaning 'what is scattered, sown.' The semantic development in the nouns extends from 'what is sown' from 'origin or base of a plant' to any 'origin, base' and specializes from 'origin, base of a plant' to 'stem of tree' to 'handle, grip.'

Given the lexicalization of a deverbal intensive suffix pMo **r-* in a number of Mongolic verb stems (e.g., WMo. *ayimu-* 'to become confused, mixed up, go astray, be unintelligible (intr.)' → *ayimur-* 'to change for the worse, indulge in lustful pursuits, be seduced, be heavily confused (intr.),' *ciki-* 'to jam, stuff, press, push; stuff oneself, overeat (tr./intr.)' → *cikir-* 'to be unable to pass through or fit in, get stuck,' *sibqa-* 'to scrape out, scoop out, empty out (tr.)' → *sibqar-* 'to squeeze out, pour out to the last drop, empty out (tr.)' and *jaki-* 'to give instructions, to entrust, to give an order for, to ask to run an errand (tr.)' → *jakir-* 'to rule, govern, direct, subordinate, subject (tr.)'), we can reconstruct the bare root pMo **hüsü- ~ *hisü-/hesü-* 'to sprinkle, throw out, jump around.' The noun **hisi/*hesi* 'origin or base of a plant, shoot' can be derived from the root **hesü-/*hisü-* by suffixation of the deverbal noun suffix pMo **i*, e.g., in WMo. *sönü-* 'to be extinguished, go out (of fire), cease to be' → *söni* 'night, at night' (Robbeets 2015: 462–463).

Monguor *fiʒuru-* 'to sprinkle, pour, cast (metal)' preserves a reflex of the high front vowel in pMo **hisür-*. The reconstruction of initial pMo**h-* is supported by the Buriat, Dagur, Eastern and Monguor verbs and by the Dagur, Kangjia and Baoan nouns. The antiquity of initial **h-* and its origin in pre-pMo **p-* is further supported by the borrowing of the term as pTg **pesin* 'handle' (in Manchu *fesin*, Sibe *fesən*, Evenki *hesin*, Even *hesïn*, Negidal *xesin*, Olcha *pesi(n),* Orok *pesi(n),* Nanai *pesĩ*, Oroch *xesi(n)* and Udehe *xehi*). The observation that the Tungusic meaning is limited to 'handle,' which is secondary in Mongolic, is indicative of borrowing.

The Tungusic verbs reflect the meaning 'to sprinkle, to scatter.' The meaning 'to sow' is not attested, but the polysemy is observed in other Tungusic verbs, e.g., Sibe *swata-* 'to sprinkle, sow' (Kim et al. 2008: 150). The noun pTg **pisi* 'what is scattered, what is sown' can be derived from the verb **pisi-* 'to sprinkle with the hands' by suffixation of the deverbal noun suffix pTg **i*, reflected, for instance, in Even *tet-* 'to dress oneself' → *teti:* 'garment, uniform' and Evk. *usi:-* 'to bind' → *usi:* 'rope, belt' (Robbeets 2015: 461–462). Although I cannot explain the final vowel in pTg **pise* 'offspring,' I think it concerns a nominalization of the same verb. The

semantic development probably went over 'seed' in a similar way as the polysemy in K *ssi* '1 seed, 2 lineage, descent,' as discussed below. Starostin et al. (2003) gloss the word *hesen* from the Okhotka dialect of Even as 'seed, offspring, kin,' but I have not been able to trace that form back. Since the final nasal in Okhotka Even *hesen* and Manchu *fisen* is instable and frequently drops when inflectional suffixes are attached, I do not consider it part of the root.

The morphological complexity of Manchu *fisitun* 'millet bowl' suggests that pTg **pisi-ke* 'broomcorn millet' includes a petrified derivational suffix of the shape pTg **-kA*, found in the names of animals and plants, e.g., in pTg **tasa-ka* 'tiger' (e.g., Ma. *tasxa*, Jurchen *tasxa*, Solon *tasax*), pTg **kumi-ke* 'louse' (e.g., Evk./Even/Neg. *kumke* and Evk. *kumikēn* 'insect,' Na. *kuŋke*, Ud. *kumuge*, Solon *xuŋkē* and *xumīxe* 'ant'), pTg **inū-ke* 'dog, wolf' (e.g., Evk. *ńēkē* 'sable,' Even *ŋōke* 'male (of dog, wolf, fox),' Sibe *juxə* 'wolf,' Ma. *ńoxe* 'wolf,' *nuxere* 'puppy') pTg **eb-ke* 'heather' (e.g., Evk. *ebkemkirē*, Neg. *epkexin*, Orok/Oroch *ewxexi*, Na. *opokta* 'hawthorn') and pTg **bolo-ka* 'spiraea' (Evk. *boloko*, Neg. *boloxokto*, Na. *boloqto*, Ud. *bolokto*).

In Korean we find two sets of reflexes: one set reflecting **u-* vocalism and, therefore, resisting vowel loss, and another set reflecting **i-* vocalism and, therefore, subject to vowel loss and subsequent initial *sp-* clustering in Middle Korean and *pp-* reinforcement in contemporary Korean. In line with Ramsey (1993: 438; 1997), I assume that Middle Korean verb stems with complex initials that are tonic and monosyllabic and have minimal vowels (MK *o*, *u*, *i*) are created through the loss of a first-syllable vowel. This internal analysis justifies the reconstruction of the first high front vowel in **pisi-* 'to sprinkle, scatter, sow' on the basis of MK *spu·li-* 'to sprinkle,' MK *spih-* 'to sprinkle; slander,' MK *·spol-* 'to wash (tr.)' and MK *·spum-* 'sprinkle, spout, spurt'.

Korean has a number of defective converbs, recognizable by the converb ending *e/a* and preceded by an element *(u)l-*. They occur with the auxiliary verbs *ci-* 'to become,' which polarizes their intransitivity, and *ttuli-* 'to make,' which makes them transitive: e.g., K *wuk-* 'to turn'→ *wukule ci-* 'to curl up (intr.),' *wukule ttuli-* 'to make a dent in (tr.).' The transitive analytic construction in *(u)l-e ttuli-* replaces an older and almost obsolete suffix in *(u)li-* that likewise adds transitive meaning and goes back to a synthetic form *l-i-*, where *i-* reflects the causative pK **i-*, e.g., K *wuk-* 'to turn' → *wukuli-* 'to crouch, crush (tr.)' (Robbeets 2015: 310–311). These suffixes take part in the derivation of K *pusule tuli-* 'to shatter into splinters (tr.),' K *pusule ci-* 'to crumble (intr.)' and K *ppu:li-*, MK *spu·li-* 'to sprinkle; scatter; sow' from pK **pusu-* 'to sprinkle, scatter, sow.' Korean has further lexicalized two adverbial suffixes pK **l* and pK **k*, for instance, in the derivation of *santul* 'light,' *santul santul* 'in cool ripples' and *santuk* 'with a sudden chill' from pK **santɨ-* 'to be light, fresh, cool' (Robbeets 2015: 469–470). They participate in the derivation of K *pusul pusul* ~ *posul posul* 'gently raining' and K *pusik ha-* 'to plant, extend' from pK **pusu-* 'to

sprinkle, scatter, sow.' Moreover, the pluractional marker pK **(ʌ/ɨ)l-*, indicating that an action is carried out multiple times, by multiple agents or on multiple objects (e.g., in MK *·spo(l)-* 'to sip, inhale,' MK *·awo(l)-* 'to join together' and MK *·sko(l)-* 'to spread out, pave with (tr.)' vs. MK *·ski-* 'cloud up'), derives MK *·spol-* 'to wash (tr.)' from pK **pisi-* 'to sprinkle, scatter, sow.' Finally, the inclinational marker pK **-mɨ/ʌ-*, e.g., K *mek-*, MK *mek-* 'to eat; harbor (a feeling) (tr.)' → K *mekum-*, MK *me·kwum-* 'to hold in the mouth; to swallow, gulp down; harbor (a feeling/idea) (tr.)' (Robbeets 2015: 250–251) explains the formation of MK *·spum-* 'sprinkle, spout, spurt' from this root.

In Korean and Middle Korean, we find the causative suffixes K *ki*, *hi*, *i*, MK *·Ki*, *·Gi*, *·hi-*, *-·i-* that can be derived through velar lenition as allomorphs from pK **ki*, e.g., MK *cec-* 'to be wet' → *ce·ci-* 'to moisten (tr.)' and MK *nep-* 'to be wide' → MK *ne·phi-* 'to widen (tr.)' (Robbeets 2015: 320–321). These suffixes take part in the derivation of MK *puswoy-* 'to wash, clean, rinse (tr.)' from pK **pusu-* 'to sprinkle, scatter, sow' and of MK *spih-* 'to sprinkle' from pK **pisi-* 'to sprinkle, scatter, sow.'

In Middle Korean, we find MK *·psi* 'seed' in addition to MK *·phi* 'barnyard millet.' As hinted above, tonic monosyllabic, open stems with aspirate initials followed by a minimal vowel (*u*, *o*, *i*) can be derived from an originally disyllabic root with an initial minimal vowel, i.e., in this case, pK **pisi* 'what is sown, seed'. I assume that the addition of a velar plant suffix caused the aspiration in the term for 'barnyard millet,' i.e. pK **pisi-k* (what.is.sown-PLANT) > **pski* > **phi*.

I do not exclude the possibility that the Japanese verb *hisigu* 'crush, smash' (< **pisi-nku-*) and the verbal adjective *hisasii* 'long, long-continued' (< **pisa-si-*) are ultimately related to this etymon. This remains speculative, but the coincidence in meaning between J *hie*, OJ *pi$_1$ye* and the Korean form can hardly be coincidental. Since the vowel type (1 or 2) is not distinguished following glides in Old Japanese, there is no conclusive evidence for the reconstruction of the final vowel in OJ *pi$_1$ye* 'barnyard millet.' The possibilities are **piyai* ~ **piyia* ~ **piye*. The correspondence between the palatal glide *y-* in Japanese and the *s-* in Tungusic and Korean is irregular, but a few etymological sets within Japanese seem to involve internal alternation between *s* ~ *t* (e.g., *hisasii* 'long, long-continued' ~ *hita-* 'straight, unceasing,' *hutagu* 'close, stop up' ~ *husagu* 'close, stop up,' OJ *si* ~ *ti* 'wind, direction' etc.) and between *t* ~ *y* (e.g., *itamu* 'hurt' ~ *yamu* 'ail,' *taku* ~ *yaku* 'burn (tr.),' *tatu* ~ *tayasu* 'cut off (tr.),' etc.) Thus we cannot exclude that pJ **piyai* ~ **piyia* ~ **piye* ultimately derives from **pisai* ~ **pisia* ~ **pise*.

The convincing power of this etymology follows from the shared peculiarities of the Mongolic, Tungusic and Koreanic reconstructions. First, there is a shared alternation between the vowels in the verb bases that corresponds regularly and reconstructs back to a **u-* ~ **i-* vowel alternation in proto-Transeurasian. Second, the peculiar polysemy of 'to sprinkle' and 'to sow' is shared by the Mongolic,

Tungusic and Koreanic proto-forms. This polysemy is recurrent throughout the Transeurasian languages, including verb roots that are not cognate to the root under discussion, such as Japanese *maku* 'to sprinkle, scatter, strew, sow (seed),' *hodokosu* 'sprinkle, scatter, sow; give, perform, apply,' Sibe *swata-* 'to sprinkle, sow,' Turkish *sač-* 'to sprinkle, scatter, sow (seed),' *ek-* 'to sprinkle, scatter, drop, throw about, sow (seed),' etc. The derivation of the word fora major field crop by way of a nominalization of the verb 'to sow,' as proposed for the Tungusic term for 'broomcorn millet' and the Korean term for 'barnyard millet,' is reminiscent of the development of proto-Turkic **tarï-* 'to cultivate ground' into the deverbal noun Uzbek *tariq* 'broomcorn millet' (Savelyev, this volume).

Third, the nominal derivations with a corresponding deverbal noun suffix are shared, as well as the suffixation of a velar plant suffix, in Tungusic and Koreanic. The formally and functionally corresponding derivations suggest that the suffixes were productive at their most recent common ancestral stage and probably on their way to lexicalization in the individual protolanguages. Due to these shared peculiarities at the phonological, semantic and phonological level, this etymology provides a strong argument for cognacy, while it is unlikely to be the result of borrowing.

From the perspective of cultural reconstruction, it is informative that the semantic development from 'sprinkle' to 'sow' and the morphological derivation from 'sow' to 'what is sown' to 'seed' took place at the stage of proto-Transeurasian. This allows us to infer that sowing, and thus plant cultivation, was adopted and gradually developed by the speakers of proto-Transeurasian. We find a similar situation in Indo-European, where the derivation from pIE **seH$_1$-* 'to sow (seed)' to **séH$_1$mn̥* 'seed' can be reconstructed to the level of the ancestral language because both the verb roots and derived nouns are regularly corresponding and derived by way of a common deverbal noun suffix: e.g., in Germanic, Old English *sāwan* 'to sow,' Gothic *saian* 'to sow' and Old High German *sāmo* 'seed'; in Romance, Latin *serō* 'I sow' and *sēmen* 'seed'; in Slavic Old Church Slavonic *sějǫ* 'to sow' and *sěmę* 'seeds'; in Baltic, Old Prussian *situn* 'to sow' and *simen* 'seed,' Lithuanian *sėti* 'to sow' and *sėkla* 'seed,' *sėmenis* 'linseed'; in Celtic, Old Irish *sīl*, Welsh *hil* 'seed'; in Sanskrit *sī́ra-* 'plow'; and in Hitite *iśḫūwāi* '(he) sows.'

The common derivation from the verb 'to sow' as well as the shared combination of the two meanings 'seed, millet' in Tungusic and Korean seems to imply that some kind of millet was targeted for its seeds and existed as a major crop in the culture un which the ancestral language was spoken. Although there is no evidence for full domestication of barnyard grass in northeast China in the Neolithic period, it is known that it formed part of the diet. The narrow range of wild grasses recovered in Neolithic sites in dry farming contexts in northeast China indicates that people were selecting the wild ancestor of Japanese barnyard millet as opposed to other grasses (Bestel et al. 2014: 264). Seeds of barnyard millet were also

retrieved from early agricultural sites of the Zaisanovka culture in the Russian Far East (Kuzmin 2013).

(3) pTEA **kuru* 'nut used for starch production such as walnut, acorn, chestnut or pine nut'
   a. Tungusic: pTg **kuri* 'pine cone, pine nut' (pTg **-ktA* collective for small items)
      Ma. *xuri* 'cone of coniferous trees', Jur. *xuri* 'cone of coniferous trees', Evk. *korekta* 'cedar nut' (Menges 1983: 274), Na. *koriči* 'water chestnut', *korekta* 'pine cone, cedar cone'
   b. Koreanic: pK **kul* 'oak < ? walnut'
      K / MK *kwul* 'oak' in K *kwul pa:m* 'acorn' (K *pa:m* 'chestnut'), MK *kwul pam* 'bristletooth oak (*Quercus serrata*)', K *kwul cham-namu* 'oriental oak (*Quercus variabilis*)' (K *cham-namu* 'oak tree'), K *kwul phi* 'oak bark' (K *phi* 'bark'), *kwul phi namu* 'Walnut-like tree (Platycaria strobilacea)'
   c. Japonic: pJ **kuru* 'walnut, chestnut'
      J *kuri* (2.3), OJ *kuri* 'chestnut', J *kurusu* 'chestnut grove', OJ *kuri/u-kuma* 'Chestnut Corner', J *kurumi*, MJ *kurumi* 'walnut (*Juglans regia*)' (MJ *mi* 'fruit, nut')

(4) pTEA **xʊsi* 'nut used for starch production such as walnut, acorn, chestnut or pine nut'
   a. Mongolic: pMo **kusi* 'walnut' (pMo **-Ga(n)* diminutive, often in plant names, e.g. WMo. *čibaɣa(n)* 'jujube', *abuɣa* 'marshmallow' etc.)
      WMo. *qusiga* 'walnut, nut; testicles', Khal. *xušga* 'walnut', Kalm. *xušg* 'walnut', Ordos *ġušiġa* 'walnut', WMo. *qusi ~ qosi* 'cedar, Siberian pine', Khal. *xuš* 'cedar, Siberian pine', Kalm. *xoš* 'cedar, Siberian pine'.
   b. Tungusic: pTg **xusi* 'acorn' (pTg **-ktA* collective for small items)
      Ma. *usixa* 'big nut', Evk. *usikta* 'oak tree', Na. *xosaqta* 'acorn', Ud. *uhikta* 'acorn'
   c. Japonic: pJ **kusi* 'chestnut'
      OJ *kusi* 'chestnut'

During the Neolithic, the West Liao River region consisted for 55% of trees, a mix of conifer and broadleaf trees, the latter category being predominantly oak (*Quercus*) and walnut (*Juglans*) and also some chestnut. Wild walnuts (*Juglans mandshurica Maxima*) are found on the floors of houses at the Xinglongwa site (Shelach 2000: 380). Analyzing starch residue on grinding stones Liu (2016) finds that people processed acorns and several plant roots for starch at least as frequently as millets. It is probably significant that it is precisely nuts such as walnut, acorn, chestnut or pine nut, which were targeted for their starch and consumed by Xinglongwa people, that turn up in the etymologies. Walnuts and acorns were also stored at early agricultural sites of the Zaisanovka culture in the Russian Far East (Kuzmin 2013).

(5) pTEA **abu* 'plant of the Althaea genus with roots rich of starch'
   a. Mongolic: pMo **abu* 'marshmallow (*Althaea officinalis*)' (pMo **-Ga(n)* diminutive, often in plant names, e.g. WMo. *čibaɣa(n)* 'jujube', *qusiga* 'walnut, nut', etc.)
   WMo. *abuɣa*, Khal. *avga* 'marshmallow (*Althaea officinalis*)'
   b. Koreanic: pK ** apok* 'marshmallow (*Althaea officinalis*)'
   K *awuk*, MK *a·wok* 'marshmallow, Althaea officinalis', modern dialect forms *apuk*, *apok*, *akwuk*, *akwu*
   c. Japonic: pJ ** apupi* 'hollyhock (*Althaea rosa*)'
   J *aoi* (3.1), OJ $apupi_1$ 'hollyhock (*Althaea rosa*)'

According to Liu (2016) roots and bulbs were targeted for their starch. The root of plants of the Althaea genus are also used medicinally.

5.2 Subsistence activities

(6) pTEA **nap-* 'to make rope'
   a. Tungusic: pTg **nap-* 'to make rope' (pTg **-ki* resultative nominalizer; Robbeets 2015: 407)
   Ulcha *lāxị*, Orok *lāpụ*, Na. *lāpị*, Oroch *lappi* 'tiers, straps (for skis)'
   b. Koreanic: pK **nap-* 'twist, spin'
   K *nah-* 'spin, weave, make yarn', K *kkunapwul* 'a string of cord' < *kkun* 'cord, string' + **nap-* 'twist, twine, spin' + *-wul* deverbal nominalizer, Kyeylim Yusa phonogram EMK *na(h)* 'string'
   c. Japonic: pJ **nap-* 'to make rope' (pJ **-a* deverbal nominalizer; Sakakura 1966: 286–303; Robbeets 2015: 156)
   J *nau* (B), OJ *nap-* 'twist, plait, weave (into rope)', J *nawa* (2.3), OJ *napa* 'rope'

The Tungusic words for 'tiers, straps (for skis)' can be derived with the resultative deverbal noun suffix pTg **-ki* from an underlying verb **nap-* 'to make rope'. Proto-Tungusic lacks initial liquids, except **l-* going back to original nasal **n-* assimilation before labial consonants (Poppe 1960: 74; Robbeets 2005: 69).

Twining can produce cloth, string or rope. Cords for making traps and nets have been found in a number of upper Paleolithic sites across the world (Tedlock 2009: 66; Soffer et al. 2000: 512–514). Therefore, twining is not necessarily linked to agriculture.

(7) pTEA **nup-* 'to sew'
   a. Tungusic: pTg **nup-* 'to prick, pierce'
      Neg. *lepu-* 'to pierce', Na. *lopqa-*, *loqpa-* 'to prick', Olcha *loqpa-* 'to prick', Orok *lüqqa-* 'to prick', Evk. *lupa-* 'to prick', *lupu:-* 'to pierce', Even *nụbas an-* 'to prick'
   b. Koreanic: pK **nwupi-* 'to sew, quilt'
      MK *nwu(·)pi-* 'to quilt', MK *nwu·pi* 'quilting'
   c. Japonic: pJ **nup-* 'to sew, stitch'
      J *nuu* B, OJ *nup-* 'to sew, stitch, embroider', pR **noCu-* 'to sew', Shuri (Okinawa) *no: yun*, Hirara (Miyako) *nu:* 'to sew', Igarashi (Yaeyama) *no:ŋ* 'to sew', Yonaguni *nuŋ* 'to sew'

The Tungusic verb stem is probably a compound of pTg **nup-* 'to prick, pierce' with a suffix **-kA-*, perhaps the allomorph of the inchoative suffix pTg **-xA-* in voiceless clusters (Robbeets 2015). Similar to the phonological environment in etymology (5) initial *l-* in the Tungusic languages is a secondary development from an original **n-*. Note that Even consistently retains the initial nasal here.

Sewing enters the archaeological record with leather clothing, and is generally older than weaving textiles. Therefore, it is not necessarily linked to agriculture.

(8) pTEA **pɔ:rɔ-* 'to weave'
   a. Turkic: pTk **pö:r-* 'to plait, weave'
      OT (Karakh.) *ör-* 'to plait (hair or other fibers)', MTk. *ör-* '1 to weave, plait, twist things together', *örmek* 'cloth woven from camel hair', Kirg. *ör-* '1', Kaz. *ör-* '1', Nog. *ör-* '1', Bash. *ür-* '1', Karaim *ör-* '1', Karakalpak *ör-* '1', Tatar *ör-* 'to plait, to knit, to darn, to interlace, to interweave, to build (a wall), to lay bricks or stones in a building', Tk. *ör-* '1', Az. *hör-* '1', Tkm. *ö:r-* '1', Gag. *yör-* '1', Uz. *ọr-*, Uig. *ö(r)-*, Yakut *ör-*, *örǖ* 'plaiting', Dolgan *ör-* 'to plait, bind together, wind', *örǖ* 'plaiting', Khalaj *hiri-*, *hör-* 'to plait', Chu. *var* 'best sort of flax', *věren* 'cord, rope'
   b. Mongolic: pMo **poro-* 'to entwine' in **poro-go-* 'to wrap' (**-gA-* causative) and **poro-ti-* 'roll, rotate' (**-ti-* intensive)
      WMo. *oriya-* '1 to tie around, entwine, wrap, bandage, wind, roll (tr.)', *oruɣa-* '1', *orči-* '2 to turn around, roll, rotate' (intr.)', MMo. *hura-* '1', *xorči-*, *horči-*, *orči-* '2', *orčul-* '2', Khalkha *oro:-* '1', *orči-* '2', Buriat *oŕō-* '1', *oršo-* '2', Kalmuck *ora:-* '1', *orčə-* '2', Ordos *oro:-* '1', *orčin* 'around', Dong. *xoro-* '1', Baoan *horə-*, Dagur *oŕe:-*, Shira-Yughur *horo:-*, Monguor *furo:-*, *xuro:-* '1'
   c. Tungusic: pTg **poro-* 'to spin, weave (nets)'
      Evk. *horol-* '1 to spin, whirl, go around', Neg. *xoyol-*, *xoyịl-* '1', Ud. *xo:li-* '1', Sibe *forə-*, *foru-* '1', Ma. *foro-* 'to turn round, turn over', *foringa-* '1', Olcha *pori-* 'to weave (nets)', *porpun* 'device for weaving nets', *po:rfu* 'spindle', Oroch *po:rpu*, *po:rfu* 'spindle'

d. Koreanic: pK *olʌ 'unit of woven fibers, component of woven fabric'
K *o:l*, MK ¨*wol* 'strand of rope, ply, warp', K *olk-* 'to tie up, bind, weave'
(< pK *olʌ 'woven fabric' + –·*kʌ-* inchoative; Robbeets 2015: 258)

e. Japonic: pJ **orə-* 'to weave'
J *oru* A 'weave', OJ *oro*$_2$ *s-* 'deign to weave', Shuri *qur-* 'weave'

For Turkic, it is commonly assumed that word initial pTk **p-* developed over a bilabial fricative into *h-*, leaving only a trace in Khalaj *h-* and finally disappearing in most of the contemporary Turkic languages. Given the attestation of Khalaj *hör-* 'plait', it is legitimate to reconstruct pTk **pö:r-* 'to plait, weave'. The initial labial stop pMo **p-* is regularly preserved in the peripheral Mongolic languages, notably as *f-* in Monguor *furo:-*, as *h-* in Shira-Yughur *horo:-* or Baoan *horə-* and as *x-* in Dongxiang *xoro-*, but it disappeared in the central Mongolic languages. The regular reflexes of pTg **p-* are Nanai/Olcha/Orok *p-*, Manchu *f-*, Evenki/Even *h-*, Negidal/Oroch/Udehe *x-* and Solon Ø (Benzing 1956: 981). Except for Oroch *po:rpu*, *po:rfu* 'spindle', which is probably a borrowing from Olcha, the cognates thus correspond regularly and suggest the reconstruction of an initial pTg **p-*. The expected reflex of pTEA **p-* is **p-* in proto-Japonic and proto-Koreanic (Robbeets 2005: 373). However, an initial labial stop sporadically drops before a (long?) rounded pJK **o(:)*, as it probably also did in the reflexes of pTEA **bɔ:l-* 'to sit down, become, be' in Japanese and Korean (Robbeets 2015: 159–163). Since Old Japanese makes no distinction between *o*$_1$ (< **o*) and *o*$_2$ (< **ə*) in initial position, I have opted for **o* in pJ **orə-* 'to weave' because it entails a regular correspondence (Robbeets 2015: 128). The root-final vowel of pJ **orə-* is an irregular fit, which may be due to vowel reduction in root-final position.

Whereas twining and sewing are not necessarily linked to agriculture, weaving certainly is. There are no pre-agricultural textiles in North and East Asia because weaving is labor-intensive and technologically complex, requiring a loom system. Only a society with food-surplus can invest in the technology and labor required (Barber 1995).

(9) pTEA **suru-* 'to grind'

a. Turkic: pTk **sür(ü)-* 'to rub, smear' (pTk **-ti-* causative-passive; Robbeets 2015: 290–292)
OT *sürt-* '1 to rub, smear (tr.)', MTk. *sür-*, *sürüt-*, *sürt-* '1', Tk. *sür-*, *sürt-*, Az. *sürt-*, Tkm. *sür-*, *sürt-*, Gag. *sürüt-*, Uz. *surt-*, Tuva *sür-*, Yakut *ür-*, Khak. *sürt-*, Kirg. *sür-*, *sürt-*, Kaz. *sürt-*, Nog. *sür-*, *sürt-*, Bash. *hŭr-*, *hŭrt-*, Balk. *sürt-*, Karaim *sürt-*, Kpak. *sür-*, *sürt-*, Kum. *sürt-*, Chu. *sĕr-*

b. Tungusic: pTg **suru-* 'to grind'
Ma. *šuru-* 'to grind, whet, sharpen'

c. Japonic: pJ **sura-* 'to grind, rub'
J *sur-* (B), *sure-* (B) 'to rub against eachother', OJ *sur-* 'to grind, rub', J *surari* 'without trouble, smoothly' (*-ri* adverbializer), *sura-sura* 'without a hitch, smoothly', Shuri *sir-* 'rub, grind', *ɕiyuŋ* 'to rub', Shodon *k'usryum*, Hirara *sïpag^{z}ï*, Ishigaki *sïsuŋ*, Kabira *suri*, Yonaguni *ccituŋ*, *ciruŋ*, pR **suri- ~ *ko-suri-* 'to rub'

With only a Manchu cognate, the reflex of this word is poorly distributed in Tungusic. In a few cases Manchu displays a palatal sibilant *š-* rather than *s-* in correspondence with words with initial *h-* in Even and initial *s-* in the other Tungusic languages. There is no internal ground for this palatalization, such as a following high vowel. However, as it concerns only a few cases and since the palatalization is restricted to Manchu, Benzing (1956: 989–990) refrains from establishing a separate palatal sibilant **š-* in proto-Tungusic.

Liu (2016: 247) stresses the significance of grinding stones throughout the entire Neolithic period in the Liao River region of Northeast China, whereas they gradually disappear from the archaeological record in the Yellow River region after 5000 BCE when millet-based agriculture was intensified. The significance of 'grinding' for Xinglongwa people is corroborated by the reconstructions for 'grinding' in (9) and 'crushing food to pulp' in (10).

(10) pTEA **niku-* 'to crush, knead'
a. Turkic: pTk **yïk-* 'to crush, demolish, destroy'
OTk. *yïk-* '1 to crush, demolish, destroy', Karakhanid *yɨq-* '1', MTk. *yɨq-* '1', Tk. *yɨk-* '1', Az. *yɨx-* '1', Tkm. *yɨq-* '1', Gag. *yɨq-* '1', Tat. *yɨq-* '1', Kirg. *ǯɨq-* '1', Karaim *yɨq- ~ yɨx-* '1', Kaz. *žɨq-* '1', Nog. *yɨq-* '1', Bash. *yɨq-* '1', Kpak. *žɨq-* '1', Kum. *jɨq- ~ jix-* '1', Uz. *yiq-* '1', Uig. *yiq-* '1', Khak. *yuq-* '1', Oirat *yɨq-*, *ɗɨq-* '1', Khalaj *yuq-* '1', Chu. (dial.) *šăx-* '1'
b. Mongolic: pMo **niku-* 'to knead, crush'
WMo. *niqu- ~ nuqu-* '1 to knead (flour), mash, crumple, rub, press, massage', *niquɣur* 'implement for kneading dough', MMo. *nuqu-* '1', Khal. *nuxa-* '1', Bur. *ńuxa-* '1', Kalm. *nuxə-* '1', Ordos *nuxu-* '1', Bao. *noġə-* '1', Dag. *nogu-* '1', Monguor *nuġu-* '1', Mog. *nuqu- ~ noqu-* 'to crush', Dong. *nuqu-* 'to hit with force'
c. Koreanic: pK **niki-* 'to crush to a pulp, knead'
K *iki-*, MK *niki-* 'to crush to a pulp, mash, knead, beat water into flour'

(11) pTEA **səmtʊ-* 'to form a layer on the surface by oxidation'
a. Tungusic: pTg **septu* – 'to become rusty'
Evk. *semtu-* 'to become rusty', *semtu* 'rust', *semtuce:* 'rustle, rusty', Neg. *semti* 'rust', Oroch *semtu-* 'to become rusty', *semtu* 'rust', Ud. *semtu-* 'to become rusty', Olcha *septu-* 'to become rusty', *septuče* 'rust', Orok *septu*

'rust', Na. *septu-* 'to become rusty', *septuce* 'rust', Ma. *sebde-* 'to become rusty', *sebden* 'rust'

b. Japonic: pJ **sampu-* 'to become rusty, to form a layer on the surface by oxidation'
J *sabi* (2.3), OJ *sabi*$_2$ 'rust, tarnish, patina', J *sabiru* (B), OJ *sabi*$_2$- 'to rust, form rust, to get rusty/old, to mature and perish after spawning (of fish)', Shuri *sabi* 'rust'

The cluster correspondence reflects a regular heteroganic cluster correspondence pTEA * *m*$^{(P)}$*T-*, whereby the nasal and the stop have a different place of articulation, which results in the insertion of a parasitic stop (Robbeets 2015: 147). The nasal is lost in the continental Transeurasian languages (here pTg **-pt-*), whereas Japanese has lost the final stop (pJ **-mp-* > OJ *-b-*).

At the first glance, this etymology may be somewhat puzzling because it seems to imply familiarity with iron. A similar paradox is found in the reconstruction of proto-Austronesian, where PAN **Namat* 'iron', and **diNaŋ* 'rust' can be reconstructed at a time depth of 3500 BC, in spite of the fact that metallurgy appeared in South East Asia only about 3000 years later. However, Blust (2013) argued that knowledge of iron does not necessarily imply knowledge of metallurgy. The Austronesian terms may be related to early Neolithic hematite pottery production, whereby iron-rich clay was turned red through a process of oxidation. It is known that at the very beginnings of pottery production in Xinglongwa, the color of different wares was important. Many ceremonial items were reddish in color, while others were grey and black. The clays were composed of ferrous minerals such as hematite (Li 2016) and the colours were attained by oxidation of these clays invoked during firing. Pottery rather than metallurgy may be the context within which this etymology should be understood.

6. Conclusion

Starting from the assumption that the Transeurasian languages represent a valid genealogical grouping, I investigated the impact of agriculture on the ancestral vocabulary as well as on the primary dispersals of proto-Transeurasian. Applying different techniques situated at the intersection of linguistics and other disciplines such as archaeology and genetics, I reached the following conclusions:

1. Proto-Transeurasian, the language ancestral to the Turkic, Mongolic, Tungusic, Koreanic and Japonic languages, reflects a broad-spectrum subsistence strategy probably including some plant cultivation and yielding food surpluses.

2. The assumed location and time depth of proto-Transeurasian associate the ancestral language with the Xinglongwa culture, the first farming society in Northeast China in the 7th and 6th millennium BC.
3. The spread of the Transeurasian languages to their present-day locations is consistent with the spread of agriculture in Northeast Asia. However, agriculture did not necessarily cause language spread by boosting the farmer's demography and pushing them to search for new land. It also followed ecological stress caused by climate change, disrupting traditional resource bases and replaced previous subsistence strategies.

Cultural reconstruction indicates that the speakers of proto-Transeurasian targeted a millet-like crop for its seeds, sowed seeds and maintained fields for cultivation. Their food surpluses were sufficient to permit labor-intensive and technologically complex activities such as weaving. They were familiar with a process of oxidation, probably in connection with iron-rich clay in hematite pottery production. In contrast to the communities in the Yellow River Basin, the speakers of proto-Transeurasian relied intensively on grinding for their food-production. The starches involved in this process were not limited to millets, but were provided by various nuts such as walnut, chestnut, acorn and pine as well as roots. The reconstructed vocabulary therefore suggests a broad-spectrum subsistence strategy with some economic dependence on the cultivation of plants such as millets.

The lexical evidence is in line with the diversity hot-spot principle, locating the homeland of Transeurasian in the West Liao River region and Bayesian inference, estimating the time-depth of the family at ca. 5700 BC. The location and time depth indicate that proto-Transeurasian may be connected with the Xinglongwa culture (6200–5400 BC) in Southern Manchuria. This culture depended on a broad-spectrum subsistence strategy including millet cultivation.

Towards the end of the Xinglongwa culture, the population expanded quickly and millet agriculture started spreading eastwards. The resulting demographic processes can be mapped on the Transeurasian phylolinguistic tree to such an extent that the major splits in the language family seem to coincide with the time and the route of agricultural expansions in Northeast Asia. This indicates that the eastward spread of the Transeurasian languages may indeed have been driven by agriculture.

Acknowledgements

The research leading to these results has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (grant agreement No 646612) granted to Martine Robbeets.

Abbreviations

Az.	Azerbaijanian
Balk.	Balkar
Bao.	Bao'an
Bur.	Buriat
Chu.	Chuvash
Dag.	Dagur
Dong.	Dongxiang (Santa)
EMK	Early Middle Korean
Evk.	Evenki (Tungus)
Gag.	Gagauz
J	(contemporary, standard Tokyo) Japanese
Jur.	Jurchen
K	(contemporary, standard Seoul) Korean
Kalm.	Kalmuk
Kaz.	Kazakh
Khal.	Khalkha
Kirg.	Kirghiz
Kpak.	Kara-Kalpak
Kum.	Kumyk
Ma.	Manchu
Mgr.	Monguor
MJ	Middle Japanese
MK	Middle Korean
MMo.	Middle Mongolian
Mog.	Moghol
MTk.	Middle Turkic
Na.	Nanai (Goldi, Hezhe)
Neg.	Negidal
Nog.	Noghay
OJ	Old Japanese
OT	Old Turkic
pJ	proto-Japonic
pK	proto-Koreanic
pMo	proto-Mongolic
pTEA	proto-Transeurasian
pTg	proto-Tungusic
pTk	proto-Turkic
pR	proto-Ryukyuan
Tat.	(Volga) Tatar
Tk.	Turkish
Tkm.	Turkmenian
Ud.	Udehe
Uig.	Uighur
Uz.	Uzbek
WMo.	Written Mongolian
'1'	Same semantics as the first meaning given
'2'	Same semantics as the second meaning given

References

Ahn, Sung-Mo. 2010. The emergence of rice agriculture in Korea: Archaeobotanical perspectives. *Archaeological and Anthropological Sciences* 2: 89–98. doi: 10.1007/s12520-010-0029-9

Ahn, Sung-Mo, Kim, Jangsuk & Hwang, Jaehoon. 2015. Sedentism, settlements, and radiocarbon dates of Neolithic Korea. *Asian Perspectives* 54 (1): 113–143. doi: 10.1353/asi.2015.0005

Barber, Elisabeth. 1995. *The Mummies of Urumchi*. New York NY: Norton.

Bawden, Charles. 1997. *Mongolian-English Dictionary*. London: Routledge.

Benzing, Johannes. 1956. *Die tungusischen Sprachen. Versuch einer vergleichenden Grammatik*. Abhandlungen der geistes- und sozialwissenschaftlichen Klasse 11. Wiesbaden: Akademie der Wissenschaften und der Literatur.

Bestel, Sheahan *et al.* 2014. The evolution of millet domestication, Middle Yellow River Region, North China: Evidence from charred seeds at the late Upper Paleolithic Shizitan Locality 9 site. *The Holocene* 24: 261.

Blust, Robert. 2013. Formosan evidence for Early Austronesian knowledge of Iron. *Oceanic Linguistics* 52: 255–264. doi:10.1353/ol.2013.0004

Cincius, Vera Ivanovna (ed.) 1975–1977. *Sravniteľnyj slovar' tunguso-mančžurskich jazykov. Vol. 1–2*. Moscow: Nauk.

Crawford, Gary W. & Lee, Gyoung-Ah. 2003. Agricultural origins in the Korean Peninsula. *Antiquity* 77: 87–95. doi:10.1017/S0003598X00061378

Crawford, Gary W. & Shen, C. 1998. The origins of rice agriculture: Recent progress in East Asia. *Antiquity* 72: 858–66. doi:10.1017/S0003598X00087494

Drennan, Robert & Dai, Xiangming. 2017. Chiefdoms and states in the Yuncheng Basin and the Chifeng region: A comparative analysis of settlement systems in North China. *Journal of Anthropological Archaeology* 29 (4): 455–468. doi:10.1016/j.jaa.2010.09.001

Hanihara, Kazurō. 1991. Dual structure model for the population history of the Japanese. *Japan Review* 2: 1–33.

Heggarty, Paul & Beresford-Jones, David. 2014. Farming-language dispersals: A worldwide survey. In *Encyclopedia of Global Archaeology*, Claire Smith (ed.), 1–9. New York: Springer.

Hunt, Harriet *et al.* 2008. Millets across Eurasia: chronology and context of early records of the genera Panicum and Setaria from archaeological sites in the Old World. *Vegetation History and Archaeobotany* 17 (1): 5–18. doi:10.1007/s00334-008-0187-1

Janhunen, Juha. 1996. *Manchuria: An Ethnic History* [Mémoires de la Société Finno-Ougrienne 222]. Helsinki: Suomalais-Ugrilainen Seura.

Jeong, Choongwon, Nakagome, Shigeki & Di Rienzo, Anna. 2016. Deep history of East Asian populations revealed through genetic analysis of the Ainu. *Genetics* 202: 261–272. doi:10.1534/genetics.115.178673

Jia, Xin *et al.* 2017. Spatial and temporal variations in prehistoric human settlement and their influencing factors on the south bank of the Xar Moron River, Northeastern China. *Frontiers of Earth Science* 11 (1): 137–147. doi:10.1007/s11707-016-0572-5

Jinam, Timothy *et al.* 2012. The history of human populations in the Japanese Archipelago inferred from genome-wide SNP data with a special reference to the Ainu and the Ryukyuan populations. *Journal of Human Genetics* 57: 787–795. doi:10.1038/jhg.2012.114

Johanson, Lars & Robbeets, Martine. 2010. Introduction. In *Transeurasian Verbal Morphology in a Comparative Perspective: Genealogy, Contact, Chance* [Turcologica 78], Lars Johanson & Martine Robbeets (eds), 1–5. Wiesbaden: Harrassowitz.

Kanzawa-Kiriyama, Hideaki *et al.* 2016. A partial nuclear genome of the Jomons who lived 3000 years ago in Fukushima, Japan. *Journal of Human Genetics*, 1–9.

Kim, Juwon, Dongho Ko, D. O. Chaoke, Yonfeng Han, Lianyu Piao, & B. V. Boldyrev. 2008. *Materials of Spoken Manchu*. Altaic Languages Series 1. Seoul: Seoul National University Press.

Kuzmin, Yaroslav V. 2013. The beginnings of prehistoric agriculture in the Russian Far East. Current evidence and concepts. *Documenta Praehistorica* 40: 1–12. doi:10.4312/dp.40.1

Lee, Gyoung-Ah. 2011. The transition from foraging to farming in prehistoric Korea. *Current Anthropology* 52 (4): 307–329. doi:10.1086/658488

Li, Tao. 2016. *Economic differentiation in Hongshan core zone communities (northeastern China): A geochemical perspective*. University of Pittsburgh doctoral dissertation.

Liu, Li *et al.* 2016. Plant-based subsistence strategies and development of complex societies in Neolithic Northeast China: Evidence from grinding stones. *Journal of Archaeological Science: Reports* 7: 247–261. doi:10.1016/j.jasrep.2016.04.014

Liu, Xinyi *et al.* 2012. The earliest evidence of millet as a staple crop: New light on Neolithic foodways in North China. *American Journal of Physical Anthropology* 149: 1–8. doi:10.1002/ajpa.22127

Martin, Samuel. 1961. *Dagur Mongolian: Texts and Lexicon*. Bloomington: Indiana University Press.

Martin, Samuel Elmo. 1996. *Consonant Lenition in Korean and the Macro-Altaic question*. Honolulu HI: University of Hawaii Press.

Menges, Karl Heinrich. 1984. Korean and Altaic. A Preliminary Sketch. *Central Asiatic Journal* 28: 234–295.

Norman, Jerry. 2013. *A Comprehensive Manchu-English Dictionary*. Harving-Yenching Institute Monograph Series 85. Cambridge, MA: Harvard University Press.

Nugteren, Hans. 2011. *Mongolic Phonology and the Qinghai-Gansu Languages*. PhD dissertation, Leiden University.

Peterson, Christian & Drennan, Robert. 2011. Patterned variation in regional trajectories of community growth. In *The Comparative Archaeology of Complex Societies*, Michael E. Smith (ed.), 88–137. Cambridge: CUP. doi:10.1017/CBO9781139022712.008

Poppe, Nicholas. 1960. *Vergleichende Grammatik der altaischen Sprachen, Teil 1: Vergleichende Lautlehre* [Porta Linguarum Orientalium, Neue Serie 4]. Wiesbaden: Otto Harrassowitz.

Ramsey, Samuel Robert. 1993. Some remarks on reconstructing earlier Korean. *Language Research* 29: 433–441.

Ramsey, Samuel Robert. 1997. The invention of the Korean alphabet and the history of the Korean language. In *The Korean Alphabet. Its History and Structure*, Young-Key Kim-Renaud (ed.), 131–143. Honolulu: University of Hawai'i Press.

Ramstedt, Gustaf John. 1906. *Mogholica. Beiträge zur Kenntnis der Monghol-Sprache in Afghanistan*. Journal de la Société Finno-Ougrienne. Helsinki: Suomalai-Ugrilainen Seura.

Ramstedt, Gustaf John. 1935. *Kalmückisches Wörterbuch*. Lexica Societatis Fenno-Ugricae 111. Helsinki: Suomalai-Ugrilainen Seura.

Ramstedt, Gustaf John. 1949. *Studies in Korean Etymology* [Mémoires de la Société finno-ougrienne 95]. Helsinki: Suomalai-Ugrilainen Seura.

Robbeets, Martine. 2005. *Is Japanese Related to Korean, Tungusic, Mongolic and Turkic?* [Turcologica 64]. Wiesbaden: Harrassowitz.

Robbeets, Martine. 2015. *Diachrony of Verb Morphology: Japanese and the Transeurasian Languages* [Trends in Linguistics Studies and Monographs 291]. Berlin: Mouton de Gruyter. doi:10.1515/9783110399943

Robbeets, Martine. 2017. Austronesian influence and Transeurasian ancestry in Japanese: A case of farming/language dispersal. *Language Dynamics and Change* 7.

Robbeets, Martine & Bouckaert, Remco. Forthcoming. Bayesian phylolinguistics and the classification of the Transeurasian languages.

Sakakura, Atsuyoshi. 1966. *Gokōsei no kenkyū* [A study of word formation]. Tokyo: Kadokawa shoten.

Shelach, Gideon. 2000. The earliest Neolithic cultures of northeast China. *Journal of World Prehistory* 14: 363–414. doi:10.1023/A:1011124209079

Soffer, Olga, Adovasio, James M. & Hyland, David C. 2000. The "Venus" figurines. Textiles, basketry, gender, and status in the Upper Paleolithic. *Current Anthropology* 41: 511–537.

Starostin, Sergej, Dybo, Anna & Mudrak, Oleg. 2003. *Etymological Dictionary of the Altaic Languages*. Leiden: Brill.

Tadmor, Uri, Haspelmath, Martin & Taylor, Bradley. 2010. Borrowability and the notion of basic vocabulary. *Diachronica* 27(2): 226–246. doi:10.1075/dia.27.2.04tad

Tedlock, Barbara. 2009. *The Woman in the Shaman's Body: Reclaiming the Feminine in Religion and Medicine*. London: Random House.

Vostretsov, Yuri E. 2006. Turning points in the cultural evolution of prehistoric Primorye. *Archaeology, Ethnology & Anthropology of Eurasia* 27(3): 25–32. doi:10.1134/S1563011006030030

Wang, Chuan-Chao *et al.* 2016. Reconstructing population history in East Asia. Presentation held at *the 7th International Symposium on Biomolecular Archaeology (ISBA7)*. The Oxford University Museum of Natural History, Oxford. 14th–16th September.

Weber, Steven A. & Fuller, Dorian Q. 2008. Millets and their role in early agriculture. *Pragdhara* 18: 69–90.

Zhao, Zhijun. 2011. New archaeobotanic data for the study of the origins of agriculture in China. *Current Anthropology* 52: 295–306. doi:10.1086/659308